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PRINT FIG. #1

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Unclas

QUICK CONNECT FASTENER

A continuing need exists for a fastener of simple construction which is locked by simple movement, i.e. insertion, of a stud or bolt threaded portion into a receptacle hole followed by a slight rotation to lock the fastener in place. Such a quick connect fastener is not currently available in a simple apparatus and method which eliminates disadvantages of commonly used bolts and other threaded connectors. It is the aim of the present invention to provide such a quick connect fastener of simple, rugged construction which insures a secured joint between members and requires a minimum of skill or effort on the part of the installer, especially in difficult environments of use.

The instant invention prevents a quick connect fastener for replacing normal bolts or screws and the like which can be installed by simply pushing a threaded portion of the bolt or stud into a member receptacle hole. The quick connect fastener is comprised of an externally threaded fastener having the threaded portion slidably mounted upon a stud or bolt shaft wherein the externally threaded fastener portion is expandable by action of preloaded spring means. Upon insertion of the quick connect fastener into a threaded hole or even an unthreaded hole, the fastener cannot be removed except by turning, for example, counterclockwise depending upon the set of the threads until it threads its way clear of the receptacle hole.

FIGURE 1 is an exploded isometric view of the quick connect fastener showing the various elements of one embodiment of the quick connect fastener;

FIGURE 2 is a side view of the quick connect fastener with the threads in a retracted position and in such a retracted position presenting a reduced thread diameter which would be the case during insertion of the connector into a receptacle hole; and

FIGURE 3 is a side view of the quick connect fastener with the threads in an engaged position with the threads exhibiting maximum outside diameter which would be the configuration of the fastener either standing alone or inserted in place within a member receptacle hole.

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PATENT APPLICATION

QUICK CONNECT FASTENER

ORIGIN OF THE INVENTION

10 The invention described herein was made by an employee of the United States Government and may be manufactured and used by or for the Government for Government purposes without the payment of any royalties thereon or therefor.

BACKGROUND OF THE INVENTION

FIELD OF THE INVENTION

15 The present invention relates to a quick connect fastener and method of use wherein the quick connect fastener replaces threaded bolts and screws. In yet another aspect, the invention relates to a quick connect externally threaded fastener for use in standard internally threaded holes, internally threaded nuts, or holes comprised of softer materials with or without threads. In still another aspect the quick connect fastener is installed by pushing the externally threaded fastener portion which is expandable into a threaded hole where by a small rotation of the
20 threads tightens the fastener into the member receptacle hole.

DESCRIPTION OF RELATED ART

25 Presently bolts or similar items have a disadvantage of being difficult to install unless properly aligned and carefully rotated into place meeting the screws of the member receptacle threads or and the threads of a conventional bolt. This is particularly true when the bolt is securing a heavy member which must be held in alignment while the bolt is being started into a threaded connection. Conventional bolts can be cross-threaded easily which will ruin not only the bolt but the threaded hole in the receptacle of the member into which the bolt is to be

installed.

Presently, various approaches have been utilized and provide fastener apparatus which are quick release or utilized fastener placing apparatus in various use requirements. For example, fastener placing apparatus of the type comprising a threaded first part which is pulled
5 towards and/or into a second part of the fastener to place the fastener. Such a fastener is comprised of two fundamental parts which may be integrated with each other and may separate during the placement operation. However, it has been found in practice that fastener placing apparatus utilizing spring-loaded means are subject to damage after continued heavy use of the apparatus resulting in faulty operation. Such fastener placing apparatus does not provide a true
10 quick connect and can still be subject to cross threading.

Quick release fasteners have been presented of the kind which are arranged releasably to connect two members and which comprise a stud assembly which extends through an opening in one of the members and a complimentary socket carried by another member, the locking of the fastener being achieved by bayonet coupling. Thus, a fastener of this type can be merely
15 by the axial movement of the stud into the socket, the movement of the bayonet type fixing into its locking position being closed by rotation produced, as a result of the actual movement, by for example, cam surfaces. These fasteners are relatively easily and quickly inserted; however do not address quick connect fastening in threaded environments.

Numerous quick release fasteners and quick attachment fasteners have been produced but
20 there has been a need for a fastener of simple construction which is locked by simple movement, i.e. insertion, of the stud or bolt threaded portion into a receptacle hole followed by a slight

rotation to lock the fastener into place. Various fastener devices are currently used, but the security of the joinder achieved by the fastener in the member receptacle obtained is not always commensurate with the degree of complexity of the existing quick connector fasteners or is achieved joinder of lasting strength requiring counter thread rotation to remove the fastener.

5 It is therefore readily apparent that what is needed in the art and is not currently available is a simple apparatus and method which eliminates the aforementioned disadvantages and which also permit a quick connect fastening mode of a threaded portion of a bolt or stud into a member receptacle hole or nut and other work pieces of metals and metal alloys as well as wood and the like which is readily achievable, i.e. simple insertion, and minimum rotation after the insertion.

10 Accordingly, it is the aim of the present invention to provide such a quick connect fastener of simple, rugged construction which ensures a secure joint between members and requires a minimum of skill or effort on the part of the installer especially in difficult environments of use.

SUMMARY OF THE INVENTION

15 The instant invention presents a quick connect fastener for replacing normal bolts or screws and the like which can be installed by simply pushing a threaded portion of the bolt or stud into a member receptacle hole. The inventive apparatus is comprised of an externally threaded fastener having the threaded portion slidably mounted upon the stud or bolt shaft wherein the externally threaded fastener portion is expandable by action of preloaded spring

20 means. After the quick connect fastener is inserted into a threaded hole or even an unthreaded hole, the fastener cannot be removed except by turning, for example, counter-clockwise

depending upon the set of the threads until it threads its way clear of the receptacle hole. Once the quick connect fastener has been pushed into the receptacle hole, only a small clockwise rotation is needed to tighten the fastener and in some applications provides not only appropriate fastening means but can be utilized for self-locking applications as well.

5 The quick connect fastener according to the invention is a bolt or stud member comprised of a head on a first end and a cylindrical shank of a basic bolt diameter and a threaded second end. The invention relates to the configuration and function of the threaded end, for example, as the head and shank of the bolt are similar in form and function to existing bolts. Threads of the invention are made onto at least two spaced-apart shells which have a conical inner surface
10 and means for permitting sliding of these shells along the axis of the bolt and while travelling toward the head of the bolt actually presenting threads of a reduced diameter by the action of external spring means. The shells have a standard raised profile on their cylindrical outer surface and a spring means mounted on the shank of the bolt and the back surface of the shells which are preloaded to force the shells toward the end of the bolt which has a stop means
15 mounted thereon.

 When the quick connect fastener is pushed into a threaded hole, the threads of the hole contact the first thread of the shells and drive the shells back away from the end of the bolt compressing the spring means which are mounted along the axis of the bolt. As the shells move toward the head of the bolt, or in a rearward path along the conical surface, that is, a surface
20 which is of reducing diameter, the shells are urged radially inward by externally mounted spring means. Such spring means reduce the outer diameter of the shells to less than the inside

diameter of the receptacle hole threads, allowing the shells to slip past the external threads of the receptacle member. Once the shells have slid past the first hole threads, threads of the shell will be forced toward the end of the bolt by the spring means along the axis of the bolt in a preloaded position against the shells backside. The shells are forced radially outward and into engaging with the hole threads by the expanding conical surface of the bolt. At this point, the quick connect fastener is positively retained in the receptacle hole and may be only removed by turning in a counter-clockwise unthreading of a clockwise threaded apparatus until the threads of the bolt and the receptacle are disengaged in the same manner of a standard bolt and nut or standard bolt and receptacle threaded member. Pulling the quick connect fastener will only drive the shells outward into engagement with the hole threads. The installation of the apparatus according to the invention is completed by pushing the bolt as far as possible into the receptacle hole and then tightening by turning, for example in a clockwise rotation, said rotation depending upon whether the threads are right- or left-handed. The shells are mounted on the bolt shaft in such a way that the shells are forced to rotate and tighten as the bolt head is turned.

These and other features and advantages of the present invention will become apparent to those skilled in the art upon reading of the following detailed description and when taken in conjunction with the drawings wherein there is shown and described various embodiments of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the course of the following detailed description, reference will be made to the attached drawings wherein:

FIG. 1 is an exploded isometric view of the quick connect fastener showing the various elements of one embodiment of the fastener in accordance with the invention;

FIG. 2 is a side view of the quick connect fastener with the threads in a retracted position and in such a retracted position, presenting a reduced thread diameter which would be the case during insertion of the connector into a receptacle hole; and

FIG. 3 is a side view of the quick connect fastener with the threads in an engaged position with the threads exhibiting maximum outside diameter which would be the configuration of the inventive fastener either standing alone or inserted in place within a member receptacle hole.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In the following description, like reference characters designate like and corresponding parts throughout the several views of the drawings.

The exploded isometric view of FIG. 1 presents the quick connect fastener apparatus wherein a bolt or stud 2 is shown having a head 4, a shank 6 with the shank 6 having a cylindrical portion 8 of a maximum diameter and a shank cylindrical portion 9 having a reduced diameter. The shank cylindrical portion 9 is continuous with a shank conical portion 10 which exhibits an increasing diameter from the cylindrical shank portion 9 to a stop 14 at a second end or opposing end of the bolt 2 from the head 4. Between the shank 6 cylindrical portions 8 and 9, a shank ridge 12 is created. Shells 16, 18, 20 and 22 are shown in the exploded view approximate to shank 6 conical portion 10. The shells have a cylindrical outer surface 23 with threads 24 mounted thereon. Shell 16 has a conical inner surface 26, shell 18 has an inner

conical surface 28 and shell 22 has an inner conical surface 30 which are clearly shown in the exploded isometric view. Shell 20 also has the same inner conical surface but is not visible in the drawing. The shells 16 through 22 have grooves 32 in the inner conical surfaces of the shells which are matable with stud grooves 34 which are within the conical portion 10 of shank 6. Depending upon the number of spaced apart shells which are fitted into the quick connect fastener apparatus of the invention, the number of grooves in the shell and grooves in the conical portion 10 of shank 6 will vary and are created in dimensional relationships to allow a key 36 to be inserted into place both fitting the shell and the shank 6 conical portion 10. These grooves and keys along with the conical configurations of the shells inside surfaces and the conical portion 10 of the shank 6 allow for sliding movement of the shells when mounted on the conical portion 10 of the shank 6 in an axial direction along shank 6. In addition, the keys such as key 36 and key 38 hold the shells in position, once in an expanded position for rotational threading in a receptacle threaded portion. The shells 16 through 22 once mounted onto the conical portion 10 of shank 6 through various groove and key means are held in a preloaded expanded configuration by coil spring 40. The coil spring 40 abuts against the shank ridge 12 and the shells enlarged thicker portions created by the shells conical inner surface. The shells 16 through 22 are held onto the shank 6 conical portion 10 in a spaced apart expandable and shrinkable configuration by spring clips 42 and 44. Spring clip 42 is mounted on the shells toward the head of the bolt and spring clip 44 is mounted on the shells toward the bolt end and stop 14. These spring clips 42 and 44 provide a spring preload for shrinking the shells 16 through 22 outside diameter as the shells are moved along the keys and conical portion 10 of

shank 6 away from the stop 14 and toward the bolt head 4. In addition, the spring clips 42 and 44 allow for expansion of the shells outside diameter when the preloaded coil spring 40 forces the shells back toward the stop 14 along the keys on a predefined control sliding movement.

The side view of FIG. 2 shows the quick connect fastener with the shells and exterior threads of the shells in a partially retracted position. In this position, coil spring 40 is compressed as a result of some force acting on the shells to drive them against the coil spring. The spring clips 42 and 44 force the shells into a reducing diameter, i.e. moving the shells more closely to one another, resulting in the thread surface having a reduced diameter and suitable for insertion into a threaded or non-threaded receptacle hole.

In FIG. 3, the threads are in an engaged position or a fully expanded diameter as a result of the coil spring 40 pushing against the shells overcoming the force of spring clip 42 and spring clip 44 radial spring action by forcing the shells along the expanding conical portion 10 of shank 6 to a point where in the movement of the shells are terminated by stop 14. In this configuration, the threads are fully extended toward the end of the stud or bolt and exists in the same position after insertion into a receptacle threaded or non-threaded hole. It being understood that a receptacle of a member to be joined or a nut must have compatible internal threads of a compatible diameter as is required by a common used bolt and nut and threaded hole in a receptacle member.

The quick connect fastener according to the invention, provides a new type of externally threaded fastener for use in standard internally threaded holes or nuts and in some cases, non-threaded holes, wherein pronounced threads can be anchored by insertion and twisting into place,

such as in soft metal and wood applications. The quick connect fastener replaces normal bolts and screws and are installed by simply pushing the bolt threaded portion into a receptacle hole. Once inserted, the bolt can be removed by backing the threads out of the threaded or non-threaded hole. The apparatus according to the invention eliminates the problems incurred with standard bolts, especially when said bolts are utilized in securing heavy parts which must be held in alignment and which present a common danger of cross-threading which not only will ruin the bolt but the threaded hole into which it is installed. Generally the quick connect fastener is comprised of a stud or bolt member to having a head 4 on one end, a cylindrical shank 6 of the basic bolt diameter and a threaded end comprised of shell threads 24. The threads 24 are produced on the surfaces of several shells, for example shells 16, 18, 20 and 22, which have a conical inner surface 26 with a raised key member 36 or 38 protruding radially inward running parallel to the axis of the bolt 2. The shells have a standard thread 24 profile on a cylindrical outer surface 23 and spring clip grooves 41 for retaining a spring clip 42 and spring clip 44 at each end. The C-shaped spring clips 42 and 44 wrap around all of the shells at each end, retaining the shells to the conical surface defined by the conical portion 10 of shank 6 on the end of the bolt distance from the head 4. The spring clips 42 and 44 are preloaded to squeeze the shells radially inward, down and back along the conical portion 10 of the shank 6 of the bolt 2. A coil spring 40 mounted between the shank 6 of the bolt 2 and rear surfaces of the shells is preloaded to force the shells toward the end of the bolt 2 and toward a stop 14 which blocks any further motion of the shells as a result of the coil spring 40 and presents a maximum outside diameter of the threads 24. The coil spring 40 preload overcomes the opposing force of the C-

shaped clips 42 and 44 and holds the shell against the stop 14 at the end of the bolt.

When the quick connect fastener is pushed into a threaded hole receptacle of a member to be connected, the threads of the hole contact the first thread of the shells and drive the shells back, away from the end of the bolt, compressing the coil spring 40. As the shells move rearwardly along the conical portion 10 of the shank 6, the shells are urged radially inwardly by the force of the spring clips 42 and 44, thus reducing the outside diameter of the shells, i.e. the threads, to less than the inside diameter of the receptacle hole threads, allowing the shells and threads to slip past the internal threads. Once the threads have slid past the hole threads, the shell threads 24 will be forced to the end of the bolt by the coil spring 40. The shells are forced radially outward and into engagement with the receptacle hole threads by movement along the conical portion 10 of the bolt. At this point of assembly, the bolt is positively retained in the hole of the receptacle member and may only be removed by turning or screwing out of contact in order to disengage the threads. Pulling the bolt will only drive the shells outward into engagement with the hole threads. The installation of the bolt is completed by pushing the bolt as far as possible into the hole and then tightening by minimum rotation in either clockwise or counter-clockwise of the bolt threads, depending upon the thread design. The keys 36 and 38 made into the shells force the shells to rotate and tighten as the bolt head is turned. To remove the tightened bolt, these engaged threads must be disengaged as with an ordinary bolt engaged by thread means.

An additional feature of the inventive quick connect fastener is a provision for shell self-locking. Self-locking of the fastener to prevent the fastener from loosening under vibration can

be accomplished without the addition of any other modification of the invention apparatus. The conical portion 10 of shank 6 drives the shells through means of the preloaded coil spring 40 radially outward until they contact the stop 14 at the end of the bolt. If the stop allows the shells to move far enough along the conical portion 10 to attempt a larger expanded diameter than the diameter of the hole, tightening the bolt will introduce a large radially outward force on the shells against the inside surface of the hole. This action is true whether the inside surface of the hole is threaded or non-threaded. Such actions as a result of force can be used to positively lock the bolt against loosening due to vibration.

An alternate embodiment of the present invention as described results when the keys are made into the conical surface of the bolt with thin walls rigidly attached to the conical surface of the bolt between the shells. The walls run along the axis of the bolt protruding radially outward from the conical portion 10 and served to fix rotation between the shells and the bolt. The walls are low enough to fit within the inside diameter of the hole threads. The threads shells have smooth, conical inside surfaces when used in this configuration.

The present invention has the advantage of quick and simple installation over ordinary bolts. The invention also has automatic thread engagement, which makes the bolt impossible to cross-thread and can be used in conjunction with any bolt or screw type made for installation in a threaded hole or non-threaded hole. The type and nature of threads can also be varied to suit a particular application, i.e. wood screw threads exaggerated metal threads for better locking and for stronger, heavy member applications.

The use of externally threaded shells within an internal conical surface to allow automatic

thread engagement of a bolt having a matching external conical surface and stop into an internally threaded hole solves numerous problems which have not been solvable in the past. Extreme environmental applications such as outerspace construction and other applications requiring quick and reliable connections are satisfied by the present invention.

5 It is obvious that many embodiments may be made of this inventive concept and that many modifications may be made in the embodiments heretofore described. Therefore it is to be understood that all descriptive materials herein are to be interpreted merely as illustrative, exemplary and not in a limited sense. It is intended that the various modifications which might readily suggest themselves to those skilled in the art be covered by the following claims, as far
10 as the prior art permits.

ABSTRACT OF THE DISCLOSURE

A quick connect fastener and method of use is presented wherein the quick connect fastener is suitable for replacing available bolts and screws, the quick connect fastener being capable of installation by simply pushing a threaded portion of the connector into a member
5 receptacle hole, the inventive apparatus being comprised of an externally threaded fastener having a threaded portion slidably mounted upon a stud or bolt shaft, wherein the externally threaded fastener portion is expandable by a preloaded spring member. The fastener, upon contact with the member receptacle hole, has the capacity of presenting cylindrical threads of a reduced diameter for insertion purposes and once inserted into the receiving threads of the
10 receptacle member hole, are expandable for engagement of the receptacle hole threads forming a quick connect of the fastener and the member to be fastened, the quick connect fastener can be further secured by rotation after insertion, even to the point of locking engagement, the quick connect fastener being disengagable only by reverse rotation of the mated thread engagement.

171

